Measures of Excess Risk

2004 Epidemiology, Biostatistics and Clinical Research Methods Summer Session
Noel S. Weiss, MD, DrPH

Part 8

		Cases	Person-years
Exposed	+	a_i	Y_{ei}
	-	c_i	Y_{oi}
			Y_i

$$\text{Adjusted RR} = \frac{\sum a_i \; Y_{oi} \div Y_i}{\sum b_i \; Y_{ei} \div Y_i}$$

$$\text{Adjusted RR} = \frac{\frac{36(79{,}631)}{111{,}450} + \frac{2(41{,}187)}{45{,}821}}{\frac{45(31{,}819)}{111{,}450} + \frac{8(41{,}187)}{45{,}821}}$$

$= 2.02$ (U.S. crude RR of 2.38)

	♂	♀
RR	2.00	2.22

Adjusted rate of facial injuries among participants in Little League Baseball who did not use faceguards

Division	Rate	Standard Population	*wt*	# of injuries expected in standard population
T-ball	1 / 1,035,105	328,245	*.283*	.317
Minor	33 / 1,442,340	484,830	*.419*	11.093
Regular	84 / 891,270	278,685	*.241*	26.265
Upper	37 / 44,060	66,705	*.058*	5.558
		1,158,465	*1.001*	43.233

Adjusted rate = 43.233 / 1,158,465

= 37.319 per million player-seasons

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Risk Ratio (Relative Risk)

Disease				Lung cancer			
Exposure	+	-	Total		+	-	Total (1 year)
+	A	B	a+b	Smokers	432	229,335	229,787
-	C	d	c+d	Nonsmokers	27	142,078	142,105
RR = $\frac{a/a+b}{c/c+d}$				RR = $\frac{432/229,787}{27/142,105}$ = 9.9			

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I_e = incidence in exposed = a/a+b = absolute risk

I_o = incidence in non-exposed = c/c+d

I = total incidence

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Risk Difference

- Incidence of disease associated with exposure among exposed individuals

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Attributable Risk (AR)

- Incidence of disease due to exposure among exposed individuals

$I_e - I_o$= 432/229,787 - 27/142,105 in one year

= 188/100,000 - 19/100,000 in one year

= 169/100,000 in one year

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Attributable Risk Percent (AR%)

- Percentage of disease in exposed individuals due to exposure

$$\frac{I_e - I_o}{I_e} \times 100 = \frac{188 - 19}{188} = 89.9\%$$

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Population Attributable Risk (PAR)

- Risk of disease incidence in population as a whole due to exposure ($I - I_o$)
- Given an annual risk of lung cancer of 123 per 100,000 for all men in this ago group (i.e. 423/371,892) :

PAR = 123/100,000 - 19/100,000 in one year

= 104/100,000 in one year

Population Attributable Risk Percent (PAR%, etiologic fraction)

- Percent of disease incidence in population as a whole due to exposure

$$\frac{I - I_o}{I} \times 100 = \frac{123\text{-}19}{123} \times 100 = 85\%$$

Instantaneous Incidence

- If instead of risks (cumulative incidence), the data are in the form of rates (instantaneous incidence), then the following terms apply (although they are not often used, even by those who know enough to do so):
  - Rate ratio
  - Rate difference
  - Attributable rate
  - Attributable rate percent
  - Population attributable rate
  - Population attributable rate percent

Measures of Excess Risk

Measure of risk	Abbreviation	Helps to answer the question:
Risk ratio (relative risk, rate ratio)	RR	Does exposure (E) cause disease (D)?

Measures of Excess Risk

Measure of risk	Abbreviation	Helps to answer the question:
Risk difference (attributable risk to the exposed)	AR	(If it is inferred that E causes D) Among persons exposed to E, how much of D is E responsible for? Should anything be done to modify or eliminate E?
Attributable risk (%)	AR%	(If it is inferred that E causes D) What fraction of the occurrence of disease in exposed individuals is due to the exposure?

Measures of Excess Risk

Measure of risk	Abbreviation	Helps to answer the question:
Attributable risk to the population	PAR	(If it is inferred that E causes D) What rate of D in the population is caused by E? Should resources be allocated to controlling E or, instead to exposures causing greater health problems in the population?

Measures of Excess Risk

Measure of risk	Abbreviation	Helps to answer the question:
Attributable risk to the population (%)	PAR%	(If it is inferred that E causes D) What portion of D in the population is caused by E? Should resources allocated to combating D be directed toward etiologic research or control of known etiologies (e.g., E)?

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Measures of Excess Risk

Measure of risk	Abbreviation	Helps to answer the question:
(Statistical significance)	___	How likely is it that in the absence of a true association between E & D, the association observed (or even a stronger one) would have been present?

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Epidemiologic Perspectives

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- Ed Boyko, MD, MPH, Seattle ERIC Director, interviews Robert Day, MD, PhD, MPH, President and Director Emeritus, Fred Hutchinson Cancer Research Center and Dean Emeritus, School of Public Health and Community Medicine, University of Washington, about progress in cancer prevention and control.